controlled hospital setting, usually to wean patients off analgesics injudiciously prescribed elsewhere. The use of narcotic analgesics is contraindicated in patients with chronic cluster headache or chronic paroxysmal hemicrania.

In all cases, patients should be reassured of the usually self-limiting nature of their attacks and that effective medications and treatments are available to relieve their suffering. Family, friends, and co-workers should be informed of the nature and pattern of cluster headaches so that they, with the physician, can support the patient with understanding and compassion.

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REFERENCES

Dalessio DJ: Migraine and cluster headache, *In* Foley KM, Payne RM (Eds): Current Therapy of Pain. Philadelphia, Pa, BC Decker, 1989, pp 170-181

Kudrow L: Management of cluster headaches: An American view; Ekbom K: Treatment of cluster headache in Europe; Sakai F, Igarashi H: Treatment of cluster headache in Asia; Cluster headache update. Headache Q 1990; 1:57-74

Raskin NH: Headache, 2nd edition. New York, NY, Churchill Livingstone, 1988, pp 99-134, 229-254

Rose FC (Chair): The Eighth Migraine Trust International Symposium: Abstracts of papers presented, London, England, September 1990

Electroencephalographic Brain Mapping

ELECTROENCEPHALOGRAPHIC (EEG) brain mapping is a digital technique that generates color-coded topographic maps of EEG activity as measured on the scalp. Such maps can help localize EEG activity such as regional slowing. Maps have also been applied to evoked potentials, localizing peaks. Statistical techniques can score how closely an individual patient's brain electrical activity corresponds to similar features in a normal population.

Electroencephalograms and evoked potentials are entered into a small computer, which calculates the amount of EEG activity in several frequency bands or the amplitudes of evoked potential peaks. The operator can print colored displays of scalp electrical activity that are abnormal or interesting. These topographic color-coded displays can then be used to communicate the location of abnormalities to patients or to physicians who are unfamiliar with reading routine polygraph EEG and evoked potential displays.

The techniques are subject to several kinds of problems. Some technical artifacts are difficult to screen out, misleading the computer into considering these to be abnormal EEG features. These include common EEG artifacts as well as new problems introduced by the computer processing itself. Clinical issues may confound attempts at automated computer diagnosis of abnormalities, including the effects of medication and a variety of medical conditions. Many different types of EEG brain mapping equipment are on the market, and applications based on one type of machine or technique are not necessarily usable with other kinds of machines. Statistical problems have also arisen. For example, basic statistical assumptions are not necessarily met in this EEG application. Confusion also exists between statistical significance and the implications of disease. Because of the variety of problems, EEG brain map tests are considered controversial for use in clinical settings and are not yet widely used or accepted.

These techniques have been applied to a variety of neurologic and psychiatric disorders. In cerebrovascular disease, these techniques can help to localize regions of impairment and detect some subtle electrical abnormalities that might be overlooked on routine EEG reading. In epilepsy, the use of coherence can help to separate subtypes of bifrontal spike-wave activity, differentiating primary generalized from focal disease with secondary bilateral synchrony. In dementia, the techniques can help to decide that EEG or evoked potential results are abnormal, especially for records in which the degree of abnormality is mild or subtle.

Insufficient medical literature is available to judge whether these techniques have any merit in the differential diagnosis of types of depression, schizophrenia, dyslexia, and neurobehavioral syndromes resulting from head trauma.

Electroencephalographic brain mapping makes the recording or reading of an EEG test more difficult. Technologists and physicians using these techniques need to be familiar with and competent in routine EEG and to have additional skills, knowledge, and abilities in the computerized techniques. Records need to be run carefully and interpreted cautiously because these computer-based techniques are prone to giving a false impression of "abnormality." Certain kinds of EEG abnormalities can be overlooked, such as epileptic spikes or other intermittent features. Physicians interpreting the EEG brain map test must be competent at reading routine EEG records. A simultaneous traditional polygraph EEG is considered a necessary part of any EEG brain map test, and the computer-based results should be considered only adjuncts to interpreting the standard EEG.

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REFERENCES

Brigell MG, Celesia GG, Salvi F, Clark-Bash R: Topographic mapping of electrophysiologic measures in patients with homonymous hemianopia. Neurology 1990; 40:1566-1570

Nuwer MR: Quantitative EEG: I. Techniques and problems of frequency analysis and topographic mapping—II. Frequency analysis and topographic mapping in clinical setting. J Clin Neurophysiol 1988; 5:1-43, 45-85

Position Statement: Assessment: EEG Brain Mapping. Minneapolis, Minn, American Academy of Neurology, 1989

Williamson PC, Merskey H, Morrison S, et al: Quantitative electroencephalographic correlates of cognitive decline in normal elderly subjects. Arch Neurol 1990; 47:1185-1188

Transcranial Doppler Study

TRANSCRANIAL DOPPLER is a noninvasive ultrasound technique that measures intracranial blood flow. It uses a pulsed-wave Doppler signal of low frequency (2 MHz) that can detect blood flow around the circle of Willis and in the vertebral-basilar arteries. Calculations of peak systolic and diastolic velocities and averaged flow (mean envelope) quantify blood flow. The accuracy of the results depends on the skill and experience of the operator and a number of biologic variables such as age, blood pressure, hematocrit, and medications that the patient may be taking.

In acute situations, the transcranial Doppler technique can measure the presence and degree of vasospasm from subarachnoid hemorrhage. The early detection of increased flow velocities can indicate the need for calcium channel blocking agents or hypervolemic-hypertensive techniques. The flow from arteriovenous malformations can be monitored preoperatively and postoperatively. These techniques are used in conjunction with anatomic techniques such as magnetic resonance imaging and angiography. Transcranial Doppler examination has also been used in the operating room to monitor cranial blood flow during carotid endarterectomies and cardiac bypass procedures. Blood flow tends